IOWA | Department of Biostatistics

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Table of Contents

2022 Iowa Summer Institute in Biostatistics Presentations

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Iowa Summer Institute in Biostatistics - University of Iowa
Department of Biostatistics

Evaluating the Effect of Covid on Hearing Aid Performance and Auditory Environments using Ecological Momentary Assessment

The purpose of this study is to explore the usefulness of premium hearing aid features relative to basic hearing aid models. Usefulness was evaluated using Ecological Momentary Assessment (EMA) methodology which involves collecting self-reported data through repeated surveys with questions to describe respondents' current or very recent (i.e., momentary) experiences and related contexts in their natural (i.e., ecological) environments. In this study EMA was collected using smart phones where the participant could respond to multiple surveys throughout the day. Our EMA survey asked a series of questions regarding participants' listening environments, listening activities, and feelings/experiences. In this study we have quantified the EMA responses on the listening environment into an entropy statistic; a higher entropy statistic corresponds to more active and diverse listening environments. Respondents' entropy levels prior to COVID were compared to their entropy levels during COVID using t tests. Simple linear regression models were then used to determine relationships between standardized entropy variables and other listening environment questions. Finally, we evaluated the relationship between entropy and hearing aid condition on EMA perception variables using linear mixed models. Estimated marginal means were calculated and compared for each perception variable: speech understanding, listening effort, loudness satisfaction, hearing aid satisfaction, and participation restriction. For all outcome variables, there was an interaction between hearing aid condition and entropy level only within the high entropy group. This suggests that premium hearing aid features are beneficial for individuals with high entropy who experience a diverse range of auditory environments but not necessarily for individuals with low entropy.

Mentors of Research Group
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Iowa Summer Institute in Biostatistics 2022 - University of Iowa
Department of Biostatistics

Hospitals as Reservoirs for *Clostridioides difficile* in the Community

Over the years, numerous studies have shown how *Clostridioides difficile* has affected the U.S. population by provoking countless instances of morbidity and mortality, leading to high healthcare usage and costs. Although *C. difficile* infections (CDIs) have been identified as one of the most common hospital-acquired infectious diseases, the number of community onset CDIs (CO-CDIs) is alarming as well. Former studies have identified factors contributing to the risk of obtaining healthcare facility onset CDIs (HCFO-CDIs); however, new evidence suggests that individuals with HCFO-CDIs could potentially influence the rate of CO-CDIs, even if a patient is identified as fully recovered and discharged. By studying over 20 million inpatient visits across six states in the U.S. from 2003 to 2015, we determined the impact HCFO-CDIs have on CO-CDIs. Through the implementation of machine learning techniques such as random forest as a real-world emulator, we found that the most significant predictors at a FIPS level are the year, the expected number of CO-CDIs in surrounding counties, the expected number of CDIs from the previous month, and age demographics. Additionally, the number of HCFO-CDIs released into the targeted and surrounding FIPS regions was a moderately important predictor. We validated our predictions against the true value of CO-CDIs before computing counterfactual predictions based upon HCFO-CDIs having no effect on community spread. Our results identified a clear distinction, where the number of CO-CDIs increases considerably when HCFO-CDIs are present. Hence, these results suggest that healthcare facilities serve as reservoirs for CO-CDIs.

Mentor of Research Group
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Sensitivity Assessment of a Two-Step Method in Skin Image Identification

Image processing is a field of an increased interest in the scientific/medical community, where the use of Red Green Blue (RGB) decomposition to extract image information has proven to be valuable. It has been shown that skin identification can be achieved by a two-step process: (1) partitioning the input data into clusters, and (2) estimating a binary predictor for each cluster for a final classification. In this project we focus on the problem of skin identification through cluster analysis, predictive modeling, and classification. Generalized Linear Models (GLM) and Feed-Forward Neural Networks (FF-NN) are evaluated for their performance in detecting skin images in the presence of noise factors. We investigate each model's performance in a sensitivity analysis. Finally, the techniques are applied to melanoma images and extended to a colonic cancer image.

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Iowa Summer Institute in Biostatistics – University of Iowa
Department of Biostatistics

Predicting Renal Failure in Patients with C3 Glomerulopathy

C3 glomerulopathy (C3G) is a group of related conditions that cause renal disease. The kidney problems associated with C3 glomerulopathy tend to worsen over time. About half of affected individuals develop end-stage renal disease (ESRD) within 10 years after their diagnosis. Kidney disease researchers at the University of Iowa have been following a cohort of C3G patients in the hopes of identifying biomarkers capable of providing advance warning that an individual may be at high risk of ESRD in the near future. This study involved creating generalised additive models that took into account previous estimated glomerular filtration rate, urine protein-creatinine ratio (UPCR), soluble C5b-9 level, and years with disease to predict future renal failure. Models were selected on the basis of R-squared values and cross validation. We found that using these biomarkers provide a modest improvement in the ability to predict disease progression.

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